Pressure Relief System

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Declaration

SPECIFICATION:

TITLE OF INVENTION: Pressure Relief System

CROSS REFERENCE TO RELATED APPLICATIONS: Subject matter was disclosed in provisional application serial number 60/220, 609 filed at United States Patent Office on July 25, 2000.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT: This invention was NOT made by an agency of the United States Government, NOR under a contract with an agency of the United States Government.

BACKGROUND OF THE INVENTION:

1. FIELD OF THE INVENTION

   This invention relates generally to pressure relief and control devices used for safety purposes to prevent ruptures and explosions of boilers, gas cylinders, chemical reactors and other pressurized items of almost every description.

2. DESCRIPTION OF THE INVENTION

   Pressure relief devices of a number of types are well known in the art. Among them are pressure relief valves, blow out plugs and rupture discs, all of which are made entirely of solid materials that may corrode, resulting in premature release of the fluid that they contain or else fail entirely to release the held back fluid when the pressure exceeds the predetermined maximum safe pressure. Those types of problems have resulted in many jurisdictions enacting laws requiring boiler owners to have a trained person watching the boiler at all times for the purpose of taking emergency

action in the event that the pressure in the boiler reaches a dangerous level as a result of the pressure relief device on the boiler failing to operate as intended.

The present invention solves those problems by replacing the critical solid parts of a pressure relief device with a liquid, which of course is not subject to corrosion or failure due to corrosion. Hence, it results in a totally safe, self regulating installation that would, both technically and legally, (due to the fact that the system would be open to the air at all times like a frying pan of water boiling on a stove), NOT require someone to watch the boiler while in operation. This results in substantial savings in labor expenses. Obviously the present invention can be used on other pressurized systems and vessels as well as boilers.

3. BRIEF SUMMARY OF THE INVENTION

Briefly, the invention utilizes a vertical or diagonal column of liquid of one or more types, which acts as the sealing plunger, and/or spring would in an ordinary pressure relief valve so as to hold back the pressurized fluid contained within. The column can be constructed in innumerable different configurations. (Examples: "U" tubes; "J" tubes; tubes with one end extending down into a body of water such as a well, lake, ocean, tank, etc. with the end of the tube open so that the pressure at the depth of the body of water is the effective containment force). Thus eliminated are all or almost all moving solid parts that could otherwise corrode, jam, prematurely rupture, or erode when functioning. Hence, in many configurations of this invention, all of the various complicated parts of a typical pressure relief valve are replaced by a simple tube of some particular configuration, partially or completely filled with liquid and/or surrounded by a liquid on the other end. In some other configurations of this invention, a check valve is also included in the system. In many cases, the use of more than one tube in a given system is advantageous.

4. BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows an extremely simple system where a column of water and/or other liquid in a pipe and reservoir above a check valve acts as the pressure relief device for a steam boiler.

Figure 2 shows another embodiment of this invention whereby the pressure relief system also acts as a water replenishment system for the boiler it protects.

5. DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to Figure 2, reference numeral 10 generally identifies my Pressure Relief System attached to a Steam Boiler 11 and through Steam Boiler 11, to the Steam Generator or Drum 12 and the rest of the steam system, most of which is not shown, being irrelevant to the invention at hand. Reservoir 13 is supplied with make-up water via Float Valve14 so as to prevent the water level in Reservoir 13 from dropping below a certain level, although the water level in Reservoir 13 can rise considerably above that certain level as the pressure builds up in the Boiler 11, Drum 12, etc., and pushes the water level down in the Drum 12 and up in the Reservoir 13. As the pressure increases further, all liquid water in Drum 12 is pushed by the steam pressure down Drum Supply Pipe 15 and Drum Water Return Pipe 16 and on into the Boiler 11, etc. Finally, when the pressure in the Boiler 11, etc., reaches a point that it pushes the liquid water level below the point where Pressure Relief Pipe 17 enters the Boiler 11, steam shoots up the Pressure Relief Pipe 17 into Reservoir 13 where it can freely bubble to the surface therein and go off safely into the air, thus preventing the pressure in the Boiler 11, etc., from rising any higher. Boiler Water Supply Pipe 18 normally keeps the Boiler 11 supplied with any make-up water needed, and prevents the Boiler 11 from boiling dry, even when the Boiler 11 over pressurizes and discharges steam through Pressure Relief Pipe 17.

Figure 1 shows a slight variation of Figure 2 that is suitable for higher-pressure applications. In Figure 1, reference numeral 100 generally identifies a higher-pressure version of the Pressure Relief System connected to a steam system. Connector Pipe 124 connects the upper steam area of Steam Generator or Drum 112 to Check Valve 123, which is connected via Pressure Relief Pipe 117 to Reservoir 113, which in turn is kept full of water to a certain minimum level by a Float Valve 114. Whenever the pressure in Drum 112 and Connector Pipe 124 exceeds the downward pressure exerted against the Flapper 126 in Check Valve 123 by the water column in Pressure Relief Pipe 117 and Reservoir 113 under the force of gravity, the pressure in the Connector Pipe 124 will push the Flapper 126 open and discharge up through Pressure Relief Pipe 117 and Reservoir 113 out into the open air. The maximum pressure allowable in Drum 112 determines the distance from Check Valve 123 to

Float Valve 114, times the density of the liquid contained therein. For even higher pressure systems, in order to avoid excessive heights, multiple units of this Pressure Relief System can be connected in series with all but the unit furthest from the boiler having it's Reservoir 113 fully enclosed (no open top) and connected to the next unit by the next unit's Connection Pipe 124 connecting into the reservoir side above the Float Valve 114.